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THE SEPTIC THEORY OF DENTAL CARIES.

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[Read before the Conn. Valley Dental Society, June, 1884.]

In 1877 Arthur S. Underwood, M. R. C. S., L. D. S., Eng., and W. J. Milles, L. R. C. P., London, F. R. C. and C., undertook "to determine, as far as possible, to what extent germs are present in the dental tissue when in a state of disease, and to deduce conclusions as to the effect of their presence." After four years' patient investigation, they published their first report of their progress in a paper read before the International Medical Congress, in which they say:

"We consider that caries is absolutely dependent upon the presence and prolification of organisms. This view we propose to call the 'septic theory.'"

In the examination of this theory, it will be necessary to go over a somewhat extended field of inquiry, and introduce some other theories for examination. Investigators into the phenomena of diseases are liable to seek an explanation in the insufficient evidences of their own discoveries, without taking into account what others have done or are doing in the study of questions bearing directly upon the subject

which they are examining. Especially has this been the case with recent investigators of dental caries.

When Underwood and Milles in England were making their investigations in relation to organisms, they seemingly did not take into account the discoveries of Dr. Bödecker, of New York, in relation to the distribution of living matter in bone, dentine, enamel and cementum, or of the observations of Dr. Abbott respecting the evidence of inflammation in diseased fibrils. Dr. Abbott was equally uninformed of what Underwood and Milles were proving in regard to the presence and agency of germs in the fibrils. He saw the evidences of inflammation, but not, as I think, the *true irritant.* Underwood and Milles saw the irritant, but not the *inflammatory appearances* of the fibrils, or at least did not take them into account; consequently, they announced their septic theory, and Dr. Abbott his inflammation theory. The reviewer can gather and arrange all the evidence from all sources and thus form an unbroken chain of evidence, composed of demonstrated facts and legitimate deductions from those facts, which will explain more than any theory supported only by incomplete and one-sided observations.

I propose to gather up the important facts which have been reasonably well established, bearing upon the question of caries, separating them from mere opinions, and endeavor to find what they teach.

Our subject is intimately related to questions which have occupied the attention of chemists for more than two hundred years. It is, in fact, one of the latest questions of a large and rapidly increasing number, growing out of those minute yeast granules which Leeuwenhoeck discovered in 1680, and which Cagniard-Latour, and Schwann *re*-discovered in 1836–39, and which were the starting point of that long discussion between Pasteur and Liebig and their respective schools of the true theory of fermentation, which lasted from 1840 to 1870, and which the illustrious Pasteur has completely answered by a series of experiments which, in the language of Miles, are "classed among the most brilliant records in the history of science." "The true ferments are now known to be living organisms that produce fermentation as a function of vital activity." Unlike the soluble ferments, these living organisms increase at the expense of the substance fermented. The true fermentations are purely physiological processes, which are defined by Pasteur as the "direct consequence of the processes of nutrition, assimilation and life when they are

carried on without the aid of free oxygen, or as a result of life without air." (P. S. M., p. 225.)

The discoveries of Schwann, Pasteur and others, in regard to the agency of the germs of micro-organisms, laid the foundation upon which Lister, 1865–67, established the germ theory of contagious diseases, and the septic character of some diseases not so contagious. Lister, an eminent French surgeon, had previously exhausted all the resources of the old methods of dealing with septic diseases by efforts to exclude the oxygen of the air from wounds, etc., with unsatisfactory results. The revelations of Pasteur opened his eyes to the fact that his foundation principles were defective, and consequently his methods could not be successful. In 1867 he published the results of his antiseptic (and aseptic) methods which he had been testing for two years, with previously unheard-of success. This brought about the great revolution in general surgery which immediately followed, the principles of which have been generally accepted, and now direct the methods of surgery. Without the discoveries of Pasteur and Lister the germ theory of dental diseases would have been long deferred.

In 1873, Liebig and Rottenstein published their work on Dental Caries and its Causes, which contains much of interest upon the existing theories, especially in relation to the germ theory, which they were the first to put into definite form. But the chemical theory held its ground in spite of their discoveries, because there was no Lister to give clinical demonstration of the correctness of their views. We hear but little more upon the subject except in general allusions to the theory in partial approval, or total dissent, until 1881, when Underwood and Milles published their first paper.

The failure of the chemical theory by acids to explain satisfactorily all the conditions present in caries, led these gentlemen "to seek for the presence of organisms in carious dentine with results that far exceeded their expectations."

Their first paper contains the following conclusions:

1. "We consider that caries is absolutely dependent upon the presence and prolification of organisms; that these organisms attack first the organic material and, feeding upon it, create an acid which removes the lime-salts." . . . .

2. "That suppuration of the pulp and its sequences, such as alveolar abscess, depend also upon the successful working of organisms."

In their second paper they say: "We are anxious that you should

keep clearly before you four main issues upon which all the theory which we suggested to you in 1881 depends:

1. "That certain forms of micro-organisms, viz: Micrococci, oval bacteria and short bacilli, are invariably present in carious dentine."

2. "That these micro-organisms extend into the tissue as far as does the caries."

3. "That no agent can be made to produce a change resembling caries in the absence of such micro-organisms."

(The fourth I omit.)

They add: "We feel convinced that the process, to be effective, must be carried on in a living mouth, probably because that is the only situation in which the special germs are really active. Analogy seems to warrant this deduction; but," "all we claim for the germs is, that without them and their products the process could not go on at all," "and the dental pathology of the future must include them among the most powerful factors in the production of this disease."

To Underwood and Milles the world is indebted not only for the facts which they were the first to demonstrate, but also for the impulse which their labors gave to other men to make additions to their discoveries.

In the NEW ENGLAND JOURNAL OF DENTISTRY, Jan., 1883, Prof. Mayr gives the results of a series of very careful experiments made in the line of analyzing decayed dentine. Of these experiments Underwood and Milles say: "Prof. Mayr has worked out the chemical aspect of the question with great care and exactness." That he is fully competent for a work of this kind, involving great care and labor, no candid man, who is at all acquainted with him personally, with his educational training in the best schools in Germany, his acquaintance with medical and other sciences, and especially his ability in his chosen profession as a chemist, will for a moment question. I give the results of his experiments on the point bearing on the question of dental caries. First, he says: "Let us never confound two things: the structure of a tooth and the chemical nature of a tooth, and that the structure may be broken down and the chemical nature not changed. Result No. 1: No acids or chemical lime-salts are found in the innermost decayed mass. While the chemical composition of the innermost layer is almost (and as was seen in some cases completely) identical with that of healthy teeth, the structure is totally different. The soft, white, friable decay is no longer organized, though chemically only slightly differing from the

tooth substance—one showing 72% lime-salts. The action at the innermost layer is not in accordance with what we know about the action of acids."

This paper of Prof. Mayr is full of suggestions and facts bearing directly upon the chemical aspect of the question of caries, and furnishing much evidence in favor of the septic theory.

Dr. W. D. Miller, of Berlin, within the last two years, has published many papers giving at length the processes of his experiments and observations relating to caries, which deserve notice. He then gives the description of the investigations which led him to several conclusions, of which I quote the following:

"The bacilli penetrate far into the dentine, even into the finest branches of the canaliculi. Micrococci penetrate furtherest" (i. e., further than the minutest branches (?)). "The fungi produce anatomical and pathological changes in the deeper layers, stop up the canaliculi and necessarily lead sooner or later to the death of the dentinal fibrils. The outer layers of dentine, thereby deprived of nourishment, die and fall a prey to putrefactive agents."

Dr. Miller thus fully confirms the observations of Underwood and Milles, of Lister and Rottenstein, and every other careful observer, and the presence of organisms in the deeper portion of carious dentine may be considered as fully established.

Dr. Miller differs from Underwood and Milles in this: He claims that there is a zone of softened dentine between that occupied by the organisms and the healthy dentine, which is not infected. His opinion is based on microscopical observations, and this after having said that the bacilli penetrate even into the finest branches of the dentine (softened dentine), and the micrococci penetrate further still.

Underwood and Milles, on the other hand, prove that the germs are present up to the uttermost limit of the affected dentine, by inoculating a pure culture with matter taken from the deepest portions thereof—from the very border line of decay. In other words, they find them attacking the living *organic tissue* of dentine. The question of the effect of their presence here is now the one of paramount importance. The settlement of this very interesting question does not depend upon what organisms or acids may be doing at the more superficial points of the carious mass, nor whether the acids are organic or chemical, but what is going on at the line of battle, where the amæba-like cells of the organisms and bioplasson are contending for dear life, and for food to sustain that life.

Neither Underwood and Milles, nor Dr. Miller, are able to solve this question on the theory that organisms do their work by the acids which they produce. The former say: "The essential element wanting in our artificial experiments is present in the mouth." Dr. Miller says: "I am a believer in acids, a believer in micro-organisms, and a believer in an *unknown cause;* that is, I believe that there are agents active in the production of caries which are yet to be discovered."

Two questions here arise:

1. Is the tooth endowed with living matter capable of taking on inflammatory action?

2. Is there evidence to conclude that the results of inflammatory processes in dentine are analogous to those in bone and other tissues?

In answering the first question, I will refer you to the discoveries of Prof. Heitzmann in relation to the reticular structure of protoplasm, which connect every tissue and organ as it were into one large amæba, and to the researches of Dr. Bödecker concerning "The Distribution of Living Matter in Human Dentine, Cement and Enamel," together with the evidence which your own experience furnishes in your operations upon the teeth. If these, united, do not bring evidence to your minds sufficient to make you give an affirmative answer, ask your patients. Do not think, because these tissues belong to the microscopic world, that they cannot be injured and take on inflammation. All normal and abnormal life action, whether growth or decay, the building up or the taking down of molecules and tissues, belong to the microscopic world. If you discard the vital changes in one set of tissues, why not in all? Yes, there is the intensest vitality in the reticular matter of a tooth. To talk of its low vitality is to contradict the plainest evidence that can be brought to the human intellect.

In answer to the second question, if you admit the self-evident fact of its ability to live and grow and be healthy, you must also admit its liability to disease.

This brings me to the consideration of the inflammation theory of Dr. Abbott.

It has been shown in the laboratory of Prof. Heitzmann that dentine has been dissolved and formation of abnormal tissue has taken its place. This has taken place by true physiological, though abnormal, vital processes. When Dr. Abbott was making his investigations in connection with Dr. Bödecker in regard to living matter in teeth,

he observed in the diseased fibrils of the tooth appearances characteristic of the presence of inflammation in other hard tissues, which he thus describes:

"First, irritation (which he thinks is produced by acids), followed by inflammation, swelling of the living matter, which effects the dislodgment of the lime-salts; a melting down of the glue-giving basis-substance, and a bringing to view the embryonal elements of the enamel. These processes follow in greater intensity in the dentine. The lime-salts are not necessarily dissolved and taken away, but may, and I have no doubt, as Prof. Mayr's experiments show, do remain mixed with this disorganized tooth substance." On the hypothesis that acids produce the irritation of the living matter—the reticulum—at the border-line of decay, why should they not also decalcify the lime-salts at this line? Prof. Mayr finds no trace of acids there, and Dr. Abbott accepts the conclusion that they are not there. How, then, can acids set up inflammation? When the germ theory is accepted, the presence of acids at this point will be unnecessary to account for the agents of irritation. With vital organisms feeding upon and multiplying within the pabulum contained in the canaliculi, exhausting and injuring the reticulum, which is directly connected with the reticulum of the pulp and the whole system of tissues, the usual effects of irritation follow until the melting down of the formed material, the liberation of the lime-salts from its meshes and the death of the reticulum put an end to the vital reaction, and the mass is given up to the action of organisms and their products.

The facts already presented are sufficient to establish the septic character of the disease affecting the albuminous or "animal" portions of dentine where caries is present.

In another article I shall present some of the facts already discovered in regard to the action of pathogenic organisms on soft tissues, and also examine the chemical theory which teaches that caries is simply the decalcification of the dentine by acids.

CAST METAL PLATES.

BY L. P. HASKELL, CHICAGO, ILL.

For the lower jaw it is undoubtedly true that a "cast metal plate" of Watt's, Weston's or Reese's metals is the best method for a majority of cases, especially where, as is so often the case, the absorption has been so great as to leave nothing but a thin shallow ridge of

membrane, always more sensitive than the upper jaw, and which has, in a measure, to adapt itself to the plate.

By this process there is insured a *better fit* than can be obtained by any other method, for it is cast to a non-shrinking model of plaster and pumice, or sand, or whiting. (I prefer the former.)

It is so often, in this class of cases, that plates have to be filed to relieve irritation; with this work it can be done without marring its appearance.

I like the method of casting the plate to a pattern formed of sheet wax, the edges doubled all around, so that, when finished, it has the appearance of a band, as the rubber is finished flush to that edge. Then file and partially finish, try in the mouth, and cut away where necessary; *spur* the surface with a sharp graver, and attach the teeth with pink rubber.

EDITORIAL.

ANTISEPTICS.

A friend writes us as follows: "As you say, in the May number of the JOURNAL, antiseptics have become the 'burning question' of the day, but I believe there will be found something more in the action of useful antiseptics on tissues than the germicide effect. In this connection, I have in my practice recently obtained results in the treatment of pyorrhea alveolaris which I never accomplished before, i. e., the *complete closure and healing of deep pockets* beside roots of teeth, by the use of tartrate of chinoline (injected into the pockets about three times a week). I have used hydrogen peroxide, H_2O_2, but cannot see very much in it except its cleansing—oxidizing—effect. Corrosive sublimate—bichloride of mercury—I have only used a few times, and cannot as yet form any opinion as to its efficiency, but I have no doubt it will fill a large place somewhere in our work."

In our own practice, these cases of deep pockets of pyorrhea alveolaris yield most readily to a treatment of bichloride of mercury, 1–1,000, injected two or three times a week. Our first treatment is, of course, the removal of all deposits of tartar and necrosed bone, after which the pocket is injected as above. Cases which we should heretofore have expected would require *months* to heal, under the

bichloride treatment close up and heal perfectly in as many *weeks*. Cases yield readily to this treatment that have successfully withstood carbolic acid, eucalyptol, peroxide of hydrogen, chloride of zinc, etc.

We also find the bichloride of mercury most excellent for disinfecting putrescent pulp canals. It is more rapid and thorough than anything else we have used. For this purpose we also use a solution of 1–1,000. It is non-coagulative, hence more *penetrating* in its influence. Carbolic acid so effectually *coagulates* albumen that the *agents* of sepsis may not be reached, for much time at least, but a little below the surface, and the putrefactive process may continue much longer in the tubules of the tooth than would be the case if a powerfully penetrating antiseptic was first used. After a single dressing of bichloride has been used it is, of course, well to follow with carbolic acid, or some other coagulating agent.

It seems like a trite saying to repeat, that a successful practice depends upon a diagnosis wherein is apprehended, to the fullest extent, the *exact* conditions of changes going on in the tissues and the causes which lead to those changes, and an *exact* understanding of the action of the remedies used; but it is a saying that, heretofore, never needed to be urged to the extent that it does to-day. A purely empirical practice should no longer be tolerated. For this reason we are to be congratulated that the scientific world is engaged, as never before, in the study of minute pathological changes, and the positive and direct action of remedies, especially along the line of septics and antiseptics.

DR. SEARLE'S PAPER.

We commend to our readers a careful study of the paper of Dr. Searle, on *Septics and Antiseptics*, printed in this number. He has spent a great deal of time in its preparation, and devoted to it the most conscientious and painstaking care and study. His collating, sifting and logical arrangement of the main facts resulting from the more recent investigations of our scientists in regard to dental caries is skillful, ingenuous and convincing.

Our esteemed cotemporary, *The American Journal of Dental Science*, for *May*, has just arrived—June 16. Has Dr. Gorgas got a calendar for 1884?

THE COMBINATION OF AMALGAM AND OXYPHOSPHATE.

Dr. F. Y. Clark gives the following as his method of combining amalgam and oxyphosphate so as to overcome, to a great extent if not altogether, the objectionable features of expansion and contraction of amalgam, and the discolorations of teeth by this filling material.

"Mix any amalgam in the usual way ready for use, and then with a spatula and glass slab thoroughly incorporate with any good oxyphosphate cement and accompanying liquid until the mass assumes a light grayish appearance and about the consistency of putty; then press into the cavity. When sufficiently hard to bear trimming remove the outer surface below the margin of the cavity walls and replace and finish with some good amalgam that will not discolor and at the end of a few days finish and polish. The amalgam and oxyphosphate should be mixed so as to approach as near as possible to one part of the former to three parts of the latter, just enough of the first to unite with the surface filling which should be introduced in small pieces and burnished against the main filling of oxyphosphate and amalgam so as to unite.

My attention was called to this combination of cement and amalgam several years ago by Dr. Samuel A. White of Savannah, Georgia; but on trial it was found to wash or waste away on the surface; but if used as proposed it acts admirably and removes to considerable extent many objections to the use of amalgam."

In the Senckenbergische Stifts Bibliothek (Senckenberg's endowment library) in Frankfort-on-the-Main, a whole collection of all the dental journals appearing in the world, is kept. Dr. Adolf Peterman publishes a list of thirty-one dental journals, as representing all appearing on the globe. A number of them are only what we might call, in America, advertising circulars. The average age of all of them, as far as recorded, is 9½ years for each journal. As the oldest, appears the *Dental Register;* and as the youngest, a German journal —fourteen appearing in America (of which certainly one-half is only advertising circulars, and three in England, six in France, three in Germany, one in Belgium, two in *Habana, one in Italy, and one in

*Why the Americans insist on misspelling the city of La Habana as "Havana," is unexplainable.

Spain. Sixteen are printed in the English language, or almost exactly one-half. Ash and Son, of London, publish three journals; six other "journals" are published by other dental depots, etc.

OTHER STATISTICS.—Germany produces yearly more new books than any other country. Recent returns declare the number brought out in 1883 as 14,802, while Great Britain produced 6,145, and the United States only 3,481. Comparative numbers among special classes of literature range as follows: Theology—Germany, 1,504; Great Britain, 704; United States, 375. History—Germany, 795; Great Britain, 414; United States, 119. Medicine and hygiene—Germany, 922; Great Britain, 163; United States, 211. Education and languages—Germany, 2,300; Great Britain, 556; United States, 197. Law and jurisprudence—Germany, 1,301; Great Britain, 139; United States, 397; and in the field of fiction—Germany, 1,207; Great Britain, 349; United States, 670.

Such figures are of little value if we do not think a little about them. Probably a good deal of the difference is due to the fact that it costs much more to print a book in America than it does in Germany, and that books here in America are generally bound and printed much better than German books. The production of books in Germany is to that in the United States as $4\frac{1}{4}$:1; in books about theology, the production is about 4:1; in books about history, 7:1; medicine, $4\frac{1}{2}$:1; education and languages, 12:1; law, $3\frac{1}{3}$:1; fiction, $1\frac{3}{4}$:1. This shows that the interest for historical knowledge is in Germany about seven times larger than in the United States, or that seven times more people read history than in the United States, a fact perfectly in accordance with the very defective knowledge of history, displayed even by "educated" people in the United States. The fact that "fiction" in the United States stands three times higher than history, does not speak very well for the "practical" sense of Americans. Fiction is the most unpractical of all things, and the people of the United States give themselves a bad testimony in this predilection for "fiction." Also law seems to occupy far more in proportion than science in the United States, also well explainable by those knowing the complicatedness of the different laws of the many States. Very interesting are also the statistics when compared with Great Britain: In history the two countries, England and the United States, stand as 4:1; in theology as $1\frac{3}{4}$:1; in medicine as 1:$1\frac{3}{4}$; in education and languages, as 3:1; in law, as 1:3; and in fiction as

1 :2—while in the total the proportion is $1\frac{3}{4}$:1. From this, it is plain that the law is three times more complicated in America than in England. The people in the United States like fiction and dreams twice as much as those of England, but only one-half as much as those of Germany. In medicine, the United States surpass England, while they are far surpassed by Germany. In theology, the proportion is about alike. All these people seem to like theology, and the speculation about the unknown and unknowable in the same rate, but the most conspicuous of all is the great preponderance of fiction to the account of the people in the United States. Fiction is sickly and a waste of time. It is the lazy thing in the line of reading; costs too little mental effort. The United States show too weak in educational affairs in proportion to the monstrous amount for worthless fiction. These figures are hard to dispute away and worth thinking about.

ABOUT THE RUSSIAN LANGUAGE.

St. Petersburg now has a society of dentists. Dr. Waginsky is the president of the "Pervaya Obshch-stva Dantistov w Rossiy." That is the "first society of dentists in Russia." The "oostav" or by-laws have been sent us. We wonder sometimes that Russian teeth are kept sound with that language, but think the considerable movement of the tongue necessary to pronounce Russian words has a tendency to keep the teeth clean. The English nations are very apt to think, because a word does not occur in their language, that it is very hard to pronounce; they are the poorest pronouncers of all, and the members of no other nation are so easily baffled by new words as the English. The Russian language is very much of a spelling language. Its only uncertain sounds are A (ah) and O (oh) which, with a peculiar absurdity, are very often confounded in Russian in their sounds. An O is pronounced oh and ah. The Russian alphabet has forty letters, which is not more than the English ought to have. It has a letter for soft SH and a letter for hard SH; a letter for TCH, but has no letter for H; instead of it the Russians, by another absurdity, always write G and pronounce it with the sound of G in give, so that the word Hancock in Russian would read Gankok. They pronounce such a G often resembling H. Another letter in Russian is for the combined sound SHCH, as in the words fish-chowder. There are two forms for I (ee) with only grammatical differ-

ences between them. For oo the Russians use the Greek Y. The ü in German, for which the English has no equivalent, has a special letter in Russian; the CH with the German sound has also a special letter in Russian; another special letter is for the sound YE; another, for the sound YA; another, for the sound TS, as in hats. Quite a number of Russian words consist of single consonants like s (meaning "with"), w (meaning "at"). It has also at the end of most words signs to indicate whether the last consonant is to be pronounced hard or soft.

In printing they use a modification of the Greek alphabet and not of the Latin as we do, which makes their printing look so illegible to us.

The language, as such, is extremely rich, and has no need of borrowing from any other. It has not quite the ability of building up words like the German, but supplants this defect by the great richness in suffixes and affixes. It has about nine declensions with seven cases, singular and plural, and full sounding terminations. It has no article. The verb is very defective, having only as simple tenses the present, future and imperfect, the other tenses being lacking, but this lack is supplied by additional infinitive terminations. While Russian is relatively easy to pronounce compared with English, and much less absurd in its pronunciation, it is quite difficult in its word-forms, and the cases of those Englishmen and Americans who learned Russian successfully could probably be counted within the first hundred, while the Russians who know and knew English probably are a thousand times as many.

At a recent discussion of antiseptics, by the new Military Medical Society of Woolwich, England, Surgeon Major Goodwin, in speaking of the well-worn theory of inflammation and suppuration, contended that they were no necessary result of a wound, and that repair could be obtained without them and with much less risk to life and limb. Sir Joseph Lister, in the course of the debate, spoke especially of the value, as an antiseptic, of solutions of corrosive sublimate, and said they were, in some respects, superior to carbolic acid, in that they were non-volatile, and therefore useful for cleaning sponges, instruments, hands, etc. He also praised iodoform very highly.

ANTISEPTICS.

The researches of Koch have overthrown many old notions in regard to disinfection. They show that it is not an easy task to kill developed bacteria, while the spores defy most so-called antiseptics. The most powerful of all disinfectants he found to be bichloride of mercury, its action being instantaneous in a dilution of one part in five thousand, provided, of course, there are no chemicals present, which unite with and thus render inert the disinfectant. If not thus antagonized, it can permanently check bacterial growth as long as one part in 330,000 is present in this solution.

Next, he places bromine, iodine and chlorine. Carbolic acid, the most common antiseptic agent, is by no means as reliable as is usually supposed. Nothing less than a 3% solution of it can destroy spores, requiring for this purpose at least seven days, while a 5% solution suffices only in from twenty-four to forty-eight hours. The developed forms, however, it kills readily inside of two minutes in the strength of one-half of one per cent. Its power of completely arresting bacterial development is not manifested in any dilution of less than 1 to 850, which will check splenic fever bacilli, while for the common forms of putrefaction-bacteria one part to four or five hundred is required. Koch's observations have proven the inertness of carbolic acid when dissolved in oil. In this form, it is perfectly harmless to both spores and developed bacteria. It can, hence, not be used for the disinfection of instruments or the hands, in an oily solution. But in the interior of wounds the carbolated oil is not so inert, for, under these circumstances, some of the acid is yielded by the oil to the water of the moist surface in which it dissolves to form an active solution. Dissolved in alcohol, carbolic acid is likewise wholly inert. Of other agents, Koch found very few capable of destroying *spores*. The only ones that could be relied upon to accomplish this within less than twenty-four hours were permanganate of potassium (five per cent.) and osmic acid (one per cent. solution). A five per cent. solution of chloride of iron destroyed them within six days, which neither sulphate of copper nor chloride of zinc were competent to do.

The latter agent has been much overrated by surgeons, for its presence to the extent of half of one per cent. did not even hinder the development of the bacillus anthracis. Hydrochloric acid (two per cent.), sulphuric acid (one per cent.), chromic acid (one per cent.), boracic acid (five per cent.), tannic acid (five per cent.), benzoic

acid (concentrated), dissolved in water, as well as a host of other substances, were found inert with reference to spores. On the other hand, we learn by his experiments that certain substances, while not very destructive to bacteria, can prevent their growth by their presence in minute quantities; for instance, allyl alcohol, one part in 167,000; mustard oil, one in 33,000; arsenite of potassium, one in 10,000. (This last we doubt, but would not throw it out on our own experiments, for the fault may be with us in some faulty manipulation.) Researches confirming the above have been conducted by Arloing and Thomas, but in the researches of these gentlemen it is difficult to learn whether they distinguished strictly between the spores and the developed forms. They assign to nitrate of silver a disinfectant value second only to mercuric bichloride. Sulphurous acid, an agent much used for disinfection on a large scale, was found by Koch quite unreliable. Its action on spores is very feeble. While it can kill the developed forms, if present in the air to the extent of one per cent. (by volume) within twenty minutes or less, it fails to penetrate into the interior of the thicker masses, and its effect is therefore uncertain.

Before the rôle of bacteria was understood, any substance was called a disinfectant, provided it destroyed or masked the smell of putrefaction. Subsequently, it was attempted to learn whether a so-called disinfectant destroyed the bacteria themselves. But the criterion at first chosen was imperfect. The different observers simply added the agent to the bacterial fluids, and watched with the microscope the effect upon the movements. There are many kinds of micro-organisms which never possess any movements, while when vital movements do exist, their arrest is by no means indicative of death. The only criterion of the death of bacteria is the absence of their power of multiplication when transplanted into the proper soil. By the use of appropriate methods, based on this principle, the foregoing results have been obtained.

Fumigation with sulphur has been found to be inefficient. Dr. Bucher, of Munich, has made experiments with it and found that the anthrax germs resisted the action of one ounce of sulphur burned in an air-tight chamber of one cubic yard for three days without suffering in their virulent qualities.

TRANSLATIONS.

IODOFORM AS A SPECIFIC FOR PULPITIS AND PERIOSTITIS.

BY G. WOERNER, FREUDENSTADT.

[Translated from the Zahntechnische Reform, February, 1884.]

For several years past a revolution has been taking place in the treatment of teeth having diseased pulps and in cases of periostitis, which does almost entirely away with the strong poisons formerly applied, and which enables us in most cases to save teeth that were formerly hopelessly lost, or at least deprived of their principal nourishing organ, the pulp. One of the first among those who deviated from the old method was unquestionably Mr. Witzel, of Essen, with whose phenol preparations favorable results were obtained. However, as with every novelty, when the idea has been given, improvements and alterations follow; one supplants the other. And so we are not surprised that, in a short time, a series of methods have been recommended which arrived at similar purpose, for instance, Wickersham's liquid, eucalyptus oil, etc., but not one has become universal. About two years ago a Mr. Skogsborg, dentist in Stockholm, succeeded in making an iodoform preparation that is excellent in its antiseptic qualities, and which was also adopted by Mr. Witzel. To these two authorities dentists are indebted for having made their acquisitions universal. As now several years have passed since iodoform paste was introduced into practice, though till now little was made known as to how it had worked during this time, it appears as if not a sufficient number of colleagues have made experiments with it, or that the result of their experiments had not proved satisfactory. It is this circumstance which leads me to make public my own experiments. I have used iodoform in all stages of caries, with equal success, and proceeded as follows: cavities where there is a sufficient layer of healthy dentine around the pulp, and no pain has been felt, are immediately excavated, the cavity is suitably shaped to receive the filling, all humidity removed by use of alcohol and then filled. In cavities where the pulp is still covered by a softened tooth-bone, but still pain is now and then felt, especially when excavating, I insert for a few hours a solution of carbolic acid, and fill after preparing and drying the cavity. Should the pulp be exposed by the instrument, or has this already been the case, I put in a coating of iodoform paste and then fill temporarily. With an already inflamed pulp the pain ceases

shortly after inserting the iodoform paste; it can then, in a few days, be coated over with iodoform cement and filled. In cases where the pulp has become gangrenous, and periostitis has ensued, I apply arsenic, remove the pulp, and carry the paste into the root canals, but do not fill until all inflammation has ceased. With teeth where the pulp, changed to a jelly-like mass, has formed an abscess, the first thing is cleansing of the root-canals by syringing and wiping out with a nerve broach wound around with cotton; then I insert a few crystals of hyper-manganate of lime into the roots and fill later the roots with iodoform cement. Failures are a rarity. I should be pleased if other dentists would publish their observations. The iodoform paste I have made according to the following recipe.

℞. Iodoform pulv. subtiliss, 5.0
Acid salicyl, 3.0
Morphium muriat. 1.0
Glycerin
Ol. Menthae, gtt. V.
Fiat pasta.
Label—For external use.

The iodoform cement I prepared by mixing zinc cement with half the quantity of iodoform paste.

CORRESPONDENCE.

My Dear Sir:

. . . . . .

You refer to your use of the mercuric chloride. In my own case (Riggs' disease) it was the only thing that did good, but the best results did not develop *till* ten or fifteen days after the *heroic* treatment was stopped. I do not consider that the antiseptic has any curative properties whatever. The system has the elements in and of itself, but sometimes gets overpowered and needs help to "kick the intruder out," or "strangle him," which is the office of medical aid. Bro. ——— rapped knuckles with me once for talking of "vitality," and quietly asked what it was, just as though I knew. Well, there is a something, call it what you will—a normal "concert pitch"—to which the human body is brought up, that renders it proof against death and disease, of which we have constant proof;

and while the *mind* and *body* are in this healthy normal condition, and all their many octaves are in tune, "all the powers of hell," in the shape of "bugs or infection," will find that "organism" poor hunting ground. But if, by work or worry, we lower the standard and bad blood feeds the tissues (teeth as well), then the little devils who were there all the while, "waiting on the fence," jump down and pitch in.

We must get rid of the notion that certain articles are curative in and of themselves. This idea is what has fed the quacks, from the time of the "witch of Endor," to the present time (and we have as many quacks in the profession as out). Dame Nature is ready and will do the work, only once in a while she wants a little aid in "cleaning house." This aid is what the intelligent dentist and physician should study to apply in the right direction, and at the right time. For instance, if you have a patient come to you with pyorrhea alveolaris, and, on examination, you find a flably condition of the muscles and perhaps an almost bloodless look, would you expect *any* local treatment to be responded to while the other conditions of the system were suffered to go on unchecked, and those tissues fed with blood that was loaded with effete material that should have long ago been *cast out.* A treatment that would benefit this patient would do no good to another patient suffering from the same disease, but with a full habit and in which the trouble would SEEM *to be merely local.* So, in my opinion, there are "several roads to Rome." You can give no unfailing recipes for "numbskulls" to work by, but tell them, like Opie, the artist, when asked how he mixed his colors to produce such fine work, "I mix them with brains." Tell them to mix the antiseptics well with brains and a constant habit of observation, and in time they will see the "light ahead."

Your point that the mercuric chloride prepared the way for future medication is well taken, and one which is often lost sight of. I judge, from what I observe about me here, many fall into the "bug theory" because they think, if this is true, then all we have to do is "kill 'em," and the job is done, and we get a nice fee and pass on, like the barber, to the next. Not long ago I heard a young student of Harvard Dental College complaining because the students were put through a medical drill, as being a loss of time. If the dentist does not want medical knowledge, who does? . . . .

Did you ever note the action of an external application of a mercurial on an open sore? You will almost always find that deepened

look, produced by the inflammatory action of the caustic on the tissues, which causes the margins to swell or tumify, giving a look of depth to the affected spot. A mild dressing that will not harbor bugs will help bring about a cure.

A case in point: A young lady received a severe burn on the ankle; grew worse, in spite of treatment; her doctor, an "anti-bug" fellow, brought me a portion of a white coating which covered the wound. I found "fungi" in large numbers; prescribed an ointment of mercuric oxide. On its application, it began to look better, but in time went back worse than ever. I found that the dressing was removed to satisfy the curiosity of every visitor—sometimes ten or twelve times daily. The mercurial was again applied thoroughly, the wound dressed with antiseptic cotton and closed from the contact of external air, and it healed in a few days. Do you think strange that I say mix these things with brains? . . . . .

SELECTIONS.

FERMENTATION IN THE HUMAN MOUTH.

The Influence of Antiseptics, Filling Materials, Etc., upon the Fungi of Dental Caries.

BY DR. W. D. MILLER, BERLIN, GERMANY.

[From the Independent Practitioner, June, 1884.]

Having established upon an experimental and scientific basis the fact that caries of the teeth is, to a certain extent, the direct result of the action of ferment acid or acids* upon the tissue of the tooth, followed, particularly in the case of the dentine, by the action of the ferment organisms themselves upon the decalcified tissue, it becomes a matter of the first importance to determine, first, by what means we may counteract the action of the acids or prevent their production; second, by what means we may save the already decalcified dentine from complete destruction.

Evidently there are three methods by which the desired end may be partially obtained:

1. By repeated, thorough, systematic cleansing of the oral cavity

*The chief work in the production of caries is performed by lactic acid; other acids are only auxiliary factors.

and the teeth, we may so far reduce the amount of fermentable substances in the mouth, and the number of ferment organisms, as to materially diminish the production of acid. This is so self-evident that it needs no further comment.

2. By the repeated application of alkaline substances we may, to a certain extent, neutralize the acids before they have acted upon the teeth to any considerable degree.

3. By a proper and intelligent use of antiseptics we may destroy the organisms themselves, or at least render them inactive. It is this method which is especially applicable in the second stage of dental caries (*i. e.*, the stage which follows the decalcification), and to which we will here give exclusive attention. We must, however, constantly bear in mind that by whatever method we proceed, a previous thorough cleansing of the teeth is absolutely indispensable. There is no known solution, alkaline or antiseptic, applicable in the human mouth, which will penetrate between the teeth or to the bottom of fissures and cavities, when these are filled with food, in sufficient quantities to have any appreciable effect. Therefore, before all antiseptics or alkaline washes, come the toothbrush, toothpick, and floss silk.

In my experiments for determining the action of various antiseptics upon the fungi of tooth caries, it appeared to me that by allowing the antiseptic to act upon the fungi in their natural medium, saliva, I could obtain results of more practical value than by experimenting upon them in artificial solutions, and in pure cultures, neither of which ever occur in the human mouth. Furthermore, since the fungi can attack the teeth only after a partial decalcification, we have in the first place to demand of an antiseptic, not so much that it destroys the fungi, as that it prevents the production of acid by them.* Consequently, if an acid reaction failed to appear in a solution of saliva and sugar to which a certain antiseptic had been added, as soon as in a like solution to which no antiseptic had been added (control), it was taken as evidence of the activity and value of the antiseptic used. This method could of course be used only with substances having a neutral reaction. The solutions were also subjected to a microscopical examination, to render the evidence doubly sure.

In the following table I have indicated the percentage of each antiseptic experimented upon which must be present in a sweetened-

*The production of acid may be taken as synonymous with the development of the fungi, though the failure of the acid reaction to appear after a certain length of time does not necessarily indicate that the fungi have been *devitalized*.

saliva solution, to prevent the appearance of an acid reaction in twenty-four hours, or in case of alkaline or acid antiseptics, to prevent the development of the characteristic fungi in the same time.

For example, if to 100,000 parts of sweetened saliva we add one part of bichloride of mercury, the solution will not be found acid after the lapse of twenty-four hours, even though the control became sour in four or five hours. If we add only one part to 500,000, the acid reaction will appear somewhat later than in the control.

This table is designed to show the comparative strength of the antiseptics most commonly used. The action of the antiseptics having an acid or alkaline reaction upon the fungi, was determined by the use of the microscope alone.

	Production of Acid (Development of Fungi)	
	Prevented.	Retarded.
Bichloride of mercury,	1–100,000	1–500,000
Nitrate of silver,	1–50,000	1–100,000
Iodoform,	1–5,000	1–10,000
Naphtaline,	1–4,000 (?)	1–9,000
Iodine,	1–6,000	1–15,000
Oil of mustard,	1–2,000	1–5,000
Permanganate of potas.,	1–1,000	1–2,000
Eucalyptus oil,	1–600	
Carbolic acid,	1–500	1–1,000
Hydrochloric acid,	1–500	1–1,000
Phenylic acid,	1–200	1–500
Liquid of Agate Cement,	1–250	
Liquid of Excelsior Cement,	1–225	
Lactic acid,	1–125	1–250
Carbonate of sodium,	1–100	1–200
Salicylic acid (Conc. alcohol sol.),	1–75	1–125
Alcohol,	1–10	1–20

The experiments show that bichloride of mercury is about two hundred times as powerful as carbolic acid, and demonstrate very clearly the mistake of substituting weak solutions of this antiseptic (1–1,000, as I have seen recommended) for concentrated carbolic acid. One one-thousandth is only one-fifth as powerful as pure carbolic acid, which in many cases may be used with impunity. It is consequently useless to attempt to introduce the sublimate solution for the purpose of sterilizing root canals, cavities before filling, etc., unless we may use at least a one-half per cent., if not a one per cent. solution. I see no reason, however, why this may not be done. In a few cases I have used a one per cent. solution for treating root

canals, and do not hesitate, particularly with the rubber dam adjusted, to wipe out cavities before filling with a two per cent. solution, and see no possible evil which could result from it. A well-known physiologist in Berlin has told me that he uses a one per cent. solution in his own mouth for aphthæ, and with excellent results. We should not, however, overlook the fact that a one per cent. sublimate solution is only one-fifth as powerful as pure iodoform.

As a mouth wash I have frequently used a one-tenth per cent. (1–1,000) solution myself, and have seen no bad results from it; I would not, however, recommend it to my patients in this strength. It has, besides, for me, an exceedingly disagreeable and lasting taste, which it is difficult to disguise, and produces an immediate increased secretion of saliva and mucus, which is very annoying. A one-fiftieth per cent. solution (1–5,000) may eventually be brought into use; in this concentration it is four times as powerful as a one per cent. solution of carbolic acid. The very high antiseptic power of nitrate of silver is particularly noteworthy. Why may it not be employed in place of the much more dangerous mercuric chloride?

The action of tobacco upon the fungi is worthy of notice. Five grammes of old Virginia plug were boiled fifteen minutes in fifty c. c. of water, the loss by evaporation being constantly replaced; the decoction was then filtered, and a portion added to an equal volume of saliva with sugar. This produced a mixture scarcely stronger than that which many veteran chewers carry around in their mouths all day, and in it the fungi led only a miserable existence.

Much more remarkable, however, was the action of tobacco smoke upon the fungi; the smoke from the first third or last quarter of a Colorado Claro cigar being found amply sufficient to sterilize ten c. c. of a beef-extract-sugar solution, previously richly infected with caries fungi. . . . . .

In consideration of the strong antiseptic power of tobacco smoke, we might be inclined to infer that tobacco smokers should never suffer from caries of the teeth; it is evident, however, that there are very many points in the dental arch to which the smoke never penetrates.

In the preparation of cavities for inserting fillings, it is naturally often next to impossible to remove all the carious dentine, and in all such cases it is especially desirable that the filling material itself should possess antiseptic properties, since we, in using such a material, not only destroy those organisms existing in the carious tissue,

but the material, if it remains permanently antiseptic, retards the working of the ferment organisms from without, and the appearance of secondary decay. We need, therefore, a material for filling which is not only antiseptic at the time of insertion, but which remains permanently so after being inserted.

I have endeavored to determine the relative antiseptic power of different filling materials (cements, amalgams, etc.), not only at the moment of mixing, but after they were thoroughly dry, after they had lain some hours in sweetened saliva, and after they had been an indefinite time in the human mouth.

A large number of miniature test-tubes (homeopathic pill tubes) were provided with cotton stoppers and sterilized. Into each was brought one-half c. c. of beef-extract-sugar solution, previously infected with carious fungi (pure culture). To the first tube was added a small drop of a one per cent. sublimate solution; the second tube was left untouched, and into the third, fourth, fifth, etc., were brought the filling materials whose antiseptic virtues were to be tested; these were in the form of cylinders two m. m. in diameter, and three m. m. long; if old fillings from the mouth were used, pieces were taken having approximately the same size.

These tubes now being placed in the incubator, their contents became cloudy one after the other. In those tubes which contained fillings of but slight antiseptic power, the development of the fungi proceeded rapidly, and the cloudiness soon appeared. If, on the other hand, the filling was strongly antiseptic, the development of the fungi was hindered and the cloudiness appeared later. The first tube to which the sublimate solution had been added of course remained clear, and by comparing the others with this it was easy to see just when the turbidity began to show itself; the second tube, containing no antiseptic and no filling, served as control, and the space that intervened after the control became turbid till any one of the other tubes became turbid, was a measure of the antiseptic power of the material in that tube.

As the result of a great number of experiments, I have been able to get together the following table:

When the control tube becomes turbid in five hours, then:

A tube containing an old oxy-phosphate filling becomes turbid in									5	hours.
"	"	"	oxy-chloride	"	"	"			5	"
"	"	a gold cylinder becomes turbid in					.	.	5	"
"	"	a Hill's stopping cylinder becomes turbid in						.	5	"

A lube containing an amalgam cylinder (kept 12 hours in saliva) becomes turbid in . . . . . $5\frac{1}{7}$ hours.
" " an agate cylinder (kept 12 hours in saliva) becomes turbid in . . . . . $5\frac{1}{4}$ "
" " an old amalgam filling becomes turbid in . $5\frac{3}{16}$ "
" " an amalgam cylinder (mixed dry) becomes turbid in . . . . . $5\frac{3}{8}$ "
" " an amalgam cylinder (mixed wet) becomes turbid in . . . . . $5\frac{1}{2}$ "
" " an oxy-phosphate cylinder (12 hours in saliva) becomes turbid in . . . . . $5\frac{1}{2}$ "
" " an amalgam cylinder (12 hours old) becomes turbid in . . . . . $5\frac{2}{3}$ "
" " an old filling of tin and gold becomes turbid in $5\frac{4}{5}$ "
" " an oxy-phosphate cylinder (12 hours old) becomes turbid in . . . . . 6 "
" " an agate cylinder (12 hours old) becomes turbid in . . . . . $6\frac{1}{4}$ "
" " an iodoform cement cylinder (12 hours in saliva) becomes turbid in . . . . . $6\frac{2}{3}$ "
" " a pyrophosphate cylinder (mixed dry) becomes turbid in . . . . . $7\frac{1}{8}$ "
" " a pyrophosphate cylinder (mixed wet) becomes turbid in . . . . . $7\frac{3}{8}$ "
" " an oxy-chloride cylinder (12 hours old) becomes turbid in . . . . . 9 "
" " a piece of dentine from a tooth impregnated by copper amalgam filling becomes turbid in 11 "
" " an iodoform cement cylinder (12 hours old) beturbid in . . . . . 12 "
" " an iodoform cement cylinder (fresh) becomes turbid in . . . . . — "
" " a globule of mercury becomes turbid in . . — "
" " a cylinder of black oxide of mercury becomes turbid in . . . . . — "
" " a cylinder of any copper amalgam becomes turbid in . . . . . — "
" " any old copper amalgam filling becomes turbid in — "
" " a cylinder of oxy-chloride (fresh) becomes turbid in . . . . . — "

The (—) signifies that the solution remained permanently clear.

We see from these results that the only filling at present in use which exerts a continual anti-ferment* action upon the walls of the

*I use the terms anti-ferment and anti-septic interchangeably, though the former is perhaps, preferable, since we are treating of ferment, and not septic organisms.

tooth and its immediate surroundings, is the old copper amalgam; not only that, but the very substance of the tooth containing such a filling itself becomes antiseptic, a piece of bluish or bluish-green dentine from such a tooth very powerfully retarding the development of the fungi, and, indeed, in two cases, completely destroying them. Secondary decay in such a case would be next to impossible, where anything like cleanliness was observed.

This result is well supported by observations which I have had abundant opportunity to make for the last five years, here where this material is so extensively used, and I do not hesitate to say that if our only object is to check the destruction of tissue by caries, there is no material at present in use, with which this object may be so surely accomplished as with a good copper amalgam. It is a material, however, which I have never used, though I am not aware of any bad effect produced by it beyond the discoloration of the tooth. Skogsberg's iodoform cement came into my hands too late to complete the experiments with it. It has undoubtedly strong antiseptic properties, which it does not completely lose even when exposed to the saliva, and might no doubt be used to great advantage as a foundation for permanent fillings. Old fillings of tin and gold possess slight antiseptic power, still less (almost zero) old amalgam fillings (not copper). The very inconsiderable power of amalgams to prevent the development of ferment fungi is a source of some surprise, since we have been accustomed to look upon them as very active in this respect. It is probably a mistake to attribute the hardening of dentine under amalgam fillings to the antiseptic action of the amalgam, since, in the first place, it possesses this power to but a slight degree, and in the second place the hardening may take place under fillings of gutta-percha equally well. If we dry the cavity but indifferently well, and then choose a piece of gutta-percha which we think will about fit the cavity, warm it and stuff it into the cavity, we of course can expect only bad results. If we proceed as follows we will obtain excellent results, as I have seen time and again: Adjust the dam, excavate carefully, especially the margins, wash with a strong antiseptic, dry thoroughly with bibulous paper and then with the hot-air syringe, till the surface of the dentine becomes whitish, paint with a thin solution of copal varnish, dry again with warm air, then put in the gutta-percha in small pieces one after the other, being *sure* that each piece sticks to its place, especially along the margin, just as if you were making a filling of gold. A piece which has once moved

in its place must not be allowed to remain, as a leak will be the result. Remove such a filling after two years, and the cavity will often be found in an excellent condition for a gold filling.

The oxy-chlorides, when first mixed, are powerfully antiseptic, but soon lose their energy when exposed to the action of saliva.

The oxy-phosphates are very much inferior to the oxy-chlorides in anti-septic power, and should never be used in cavities where there is much soft dentine. This conclusion is borne out by my own experience in practice, and by that of others with whom I have conversed on the subject. Dr. Paetsch first called my attention to the disastrous results of such a practice, and his testimony was confirmed by that of Dr. F. P. Abbott and others.

It must not be expected that the results given in the above table are absolutely free from error. The experiment is attended with more difficulties than are at first sight apparent; especially does the sterilization of the filling materials themselves involve much time and labor, and the results are not always constant; this was especially the case with iodoform cement. Amalgams and phosphates gave quite constant results. The tests with some of the materials were made over twenty-five times; with others, such as copper amalgams, where there was no doubt as to the result, only a few experiments were made.

Caries of the teeth, except in the later or last stage, is the result of a ferment process, and the organisms found in the deeper parts of decaying dentine, which I have isolated and obtained in pure culture, are ferment organisms. The decomposition of the pulp and contents of the root canal, attended by bad-smelling products, is, on the other hand, a putrefactive process, in which entirely different species of fungi are concerned. Whether or not the results which I have obtained for the fungi of caries would apply equally well to those putrefactive fungi, is a question which can be settled only by experiment upon pure cultures of the same.

Although I have now, as I think will be granted, established upon a sure basis a fact that caries of the teeth may result directly from the action of acid producing fungi in the presence of fermentable carbohydrates, the conclusion would hardly be justifiable that, by keeping the mouth constantly and perfectly free from all fermentable substances, or by repeated application of antacids or antiseptics to all parts of the teeth, or by all these means together, we could ever banish dental caries from the oral cavity. A most powerful influence,

which we do not well understand, is exerted by the nutritive processes in the teeth themselves.

I am assured by men who have grown old in the practice of dentistry, that mouths which have long been under their observation, and which practically have been completely free from caries for years, at once, on account of some sudden change of health, show a general breaking down or crumbling of the teeth, *en masse*, in the space of a few weeks. It has also been my experience that patients who have been dismissed by their dentists in America, with the assurance that according to previous experience their dentures would require no treatment for one or two years, have come to me a few weeks later with teeth looking as though they had not been under the hands of a dentist for years. Some say the ocean voyage spoiled their teeth; others attribute it to a change in the climate, food, health, etc.

At any rate, we have here a cause which lies without the domain of both bacteria and acids (either ferment or otherwise). The lime-salts of the teeth are supposed to form, with the organic matter of the tooth, a definite chemical compound, and it is probably due to this fact that simple salts of lime are so much more readily soluble in weak acids than pulverized tooth-bone, or that the tartar upon the teeth is so much more easily soluble than the teeth themselves; so that when any one rinses his mouth with vinegar, and afterwards finds lime in the vinegar, we know that the lime, in by far the greater part, if, indeed, we may not say altogether, came from the tartar. Now, though there is no positive evidence for the supposition, it is certainly not altogether improbable that, as a consequence of certain derangements in the nutritive functions of the teeth resulting from a change of health, etc., etc., a dissolution of the affinity between the lime-salts and the organic matter may take place, thus setting free the easily soluble lime-salts, which are then carried away in solution or washed out mechanically.

This is a supposition only, which I bring forward because facts in this case are absolutely wanting. If it should, perchance, contain a trace of truth, then adult and pulpless teeth should be less subject to these *sudden* attacks of caries than young teeth with living pulps.

There still remains much hard work to be done, before the subject of dental caries may be dismissed as having received a final solution in *all its different phases*. There are men enough in the profession, however, who are willing to work, and who do not shrink from the tasks yet to be performed.

SALICYLIC ACID A CURE FOR TIC DOULOUREUX.

We frequently meet in our practice cases of tic douloureux, that often so exceedingly painful neuralgia of the fifth nerve, where an operation seems to promise the only radical cure. If we hear of a remedy which is said to have the same effect as the surgical interference, we become doubtful; but if no less reliable an authority than Prof. Nussbaum (*Munich, Aerztl. Intelligzbl., 38, 1883,*) assures us of the fact, our hope increases. Recently a number of such cases had been sent to N. for the purpose of having the operation performed, and, after a number of carefully instituted experiments, this great surgeon recommends a trial with salicylic acid before proceeding to stretching or to resection of the nerve. In all the recently-sent cases he first tried this remedy, and he found it in every one a radical cure; not only a palliative effect, but really an utter disappearance of the painful disease was the result in every case. Especially in cases of rheumatic nature, N. is positive of having discovered in salicylic acid a specific for tic douloureux. He administered the drug in the following manner: ℞. Acidi salicylici, 0.2, gr. $3\frac{1}{3}$; Sodii salicylatis, 2.0, gr. 32; M. ft. pulv. Within 24 hours the patient takes from four to six of such powders.—*Med. and Surg. Reporter.*

With regard to the artificial production of decay under septic conditions, we should be only too delighted if we could succeed in doing what Dr. Miller appears to have done; in fact, so delighted were we when we read, about a year ago, in one of Dr. Miller's papers, of what he had done that we wrote to congratulate him and to ask him exactly how he had done it. He wrote back a very kind letter, giving us the information we had asked for, and we proceeded to repeat the experiments as nearly as we could from his description, but we could not get the same result. We placed the teeth in the mixture of saliva and bread, and did exactly as Dr. Miller directed us; but though some softening took place it was certainly not caries. If any one would like to investigate this point for himself we have the teeth so softened here for examination.

Then, with regard to these various organisms being only different forms or stages of growth of the same fungus, we have given you definite and detailed facts. We have implanted leptothrix, micrococcus, bacillus, and the oval and rod-shaped bacteria, each by itself, n little flasks, and they have grown and continued to grow for a very

long time, and, as Mr. Milles has expressed it, they have always "bred true." The bacillus has never gone on to produce leptothrix, nor have the micrococci produced bacteria, and therefore we feel justified in asserting that these organisms are not the same thing in different stages of growth, else we should have succeeded in tracing some of these changes. So that here again we put forward a fact, and not merely an assertion. . . . . .

In reply to Dr. Cunningham, we may say that we do not look upon Dr. Miller at all in the light of an opponent, but rather as a fellow investigator. We have arrived at pretty nearly the same points. Dr. Miller thinks there is a certain amount of tissue affected beyond that invaded by the micro-organisms. I do not think so, nor does Mr. Milles, but we do not consider this a very important difference; on the other hand, we consider the presence of the micro-organisms a very important factor, and so does Dr. Miller. . . .

In conclusion, I should like briefly to sum up what we have said. The micro-organisms are there; there is no doubt about that. The micro-organisms which are present can produce, and do produce, an acid. An acid and micro-organisms together can and do produce caries. Whether this can be imitated out of the mouth really does not much matter. It would be very satisfactory if one could produce caries out of the mouth, but this is not really necessary to establish our point.

One other thing which I should like to have no mistake about is this, that the principal portion of the acid in the mouth is produced by fermentation, and that those acids which are not so produced, and which are evanescent, are not in any way blameable with caries. The food gets lodged between the teeth, acid is formed, the enamel is destroyed, the micro-organisms invade the dentine, and the rest follows.—ARTHUR S. UNDERWOOD—Transactions of the Odontological Society, Great Britain.

The inflammation excited by the presence of bacteria often results in a great aggregation of *living cells* in the tissue affected. These may so act as to repel the continued advance of the fungi, which straightway perish, and the affection issues in healing and cicatrization. The fixed tissue-cells of the region may likewise act so as to check the development of the bacteria, and may further suffice to make up any loss of tissue by their regenerative activity. If this does not happen the bacterial invasion continues to advance.—*Ziegler.*

SOCIETIES.

AMERICAN DENTAL ASSOCIATION.

The twenty-fourth annual session of the American Dental Association will be held at Saratoga Springs, N. Y., commencing at 10 A. M., on Tuesday, August 5, 1884.

GEO. H. CUSHING, *Rec. Sec.*

NATIONAL ASSOCIATION OF DENTAL EXAMINERS.

The second annual meeting of the National Association of Dental Examiners will be held at Saratoga Springs, N. Y., on Friday evening, August 8, 1884. All Boards of examiners are urgently requested to send representatives to this meeting, as matters of importance are expected to be brought before it.

GEORGE H. CUSHING, *Secretary.*

TO MEMBERS OF THE CONNECTICUT VALLEY DENTAL SOCIETY.

As no action was taken at the last semi-annual meeting upon appointment of delegates to the American Dental Association, and as the active members are entitled to certificates to the number of thirty-one, those wishing credentials can apply to Dr. W. F. Andrews, Secretary, Springfield, Mass.

A. M. ROSS, *President C. V. D. S.*

HARVARD ODONTOLOGICAL SOCIETY.

The sixth annual meeting of this society was held at Young's Hotel, Boston, June 28, 1884, at 3 P. M.

Annual oration by E. H. Smith, D. M. D., Boston.

Essay, "Incidents of Office Practice," E. C. Briggs, M. D., D. M. D.

Dinner.

The following officers for the ensuing year were elected:

President, F. E. Banfield, D. M. D., Boston.

Secretary, A. J. Colgan, D. M. D., Boston.

Treasurer, W. E. Page, D. M. D., Boston.

Executive Committee, A. J. Colgan, D. M. D., E. H. Smith, D. M. D., E. C. Briggs, M. D., D. M. D.

Annual Orator, J. W. Smith, D. M. D., Newport, R. I.

Annual Essayist, A. J. Colgan, D. M. D., Boston.

HARVARD DENTAL ALUMNI ASSOCIATION.

The thirteenth annual meeting of this Association was held in Young's Hotel, June 24, 1884, the President, Dr. F. E. Banfield, in the chair. After the usual exercises and dinner, the following officers for the ensuing year were elected: President, Dr. J. G. W. Werner; Vice-President, Dr. T. O. Loveland; Secretary, Dr. Charles Wilson; Treasurer, Dr. W. E. Page.

DR. W. E. PAGE, *Sec'y.*

MASSACHUSETTS DENTAL SOCIETY.

The nineteenth semi-annual meeting of this society was held in Boston, June 5 and 6, 1884.

The various officers and committees made reports.

The meeting was called to order by the President, Dr. D. M. Clapp, Boston, June 5, at 11 o'clock, A. M.

Essay, by Dr. W. C. Starbuck, of Jamaica Plain—"The Possibilities of Hereditary Transmission of Oral Lesions."

Essay, by Dr. T. D. Shumway, Boston—"The Scientific Method in Filling Teeth."

Essay, by Dr. G. F. Waters, Boston—"Some Facts in Dental Caries."

Essay, by Dr. E. C. Leach, Boston—"Successes and Failures in the Applying of Artificial Dentures."

Essay, by Dr. C. G. Davis, New Bedford—"Methods of Tooth-saving."

Essay, by Dr. C. T. Stockwell, Springfield—"Micro-organisms and Caries," with extracts from a paper by A. S. Underwood, of England.

"Seabury's Method of Working Celluloid and Vulcanite by Super-Heated Steam," with illustrations and exhibition of apparatus, by Dr. F. W. Seabury, Providence, R. I.

Essay, Dr. G. O. Kinsman, Cambridge—"Sixth-Year Molars."

Clinic, by Prof. Thomas Fillebrown, Boston—"Hand-Pressure Filling."

Voted, That the Secretary be empowered to procure a fac-simile plate of the old certificate of membership, which was destroyed by fire.

DR. W. E. PAGE, *Secretary.*

PENNSYLVANIA STATE DENTAL SOCIETY.

The sixteenth annual session of the Pennsylvania State Dental Society will be held at Wilkesbarre, July 24, 1884, and continue in session three days. The Wyoming Valley Hotel offer special rates to delegates and their families. Orders for excursion tickets over all railroads, or other information, can be had by addressing

W. H. FUNDENBERG, *Cor. Sec.*

958 Penn. Ave., Pittsburg, Pa.

MEETING OF DELEGATES.

Delegates to the NATIONAL, and others who may act in a representative capacity, will meet in Washington City, July 22, at the Ebbitt House, where reduced rates have been made. Reduced railroad rates may be obtained by delegates uniting from a State or section.

Everything indicates a large meeting for organization. Enough States have elected delegates to insure a good attendance and a profitable meeting. The acceptability of the plan has been shown by the large number of favorable responses from every section of the United States. The East, the West, the South and the North will come together in one common cause and for one common purpose.

An organization will be put forth that will grow to the grandest proportions, reflecting honor upon the name of "American Dentistry."

B. H. CATCHING, *Correspondent.*

Atlanta, Ga., June 14, 1884.

MONTHLY LIST OF PATENTS.

For Inventions relating to Dentistry, bearing date June 24, 1884. Reported expressly for this Journal by Louis Bagger & Co., Mechanical Experts and Solicitors of Patents, Washington, D. C.

299,861. Dental vulcanizer—F. W. Seabury, Providence, R. I.
300,600. Dental rubber dam—L. M. Halsey, Brooklyn, N. Y.
300,538. Dentist's chair—J. B. Waring, New York, N. Y.
301,055. Dental-floss holder—G. E. Greene, Gardner, Mass.